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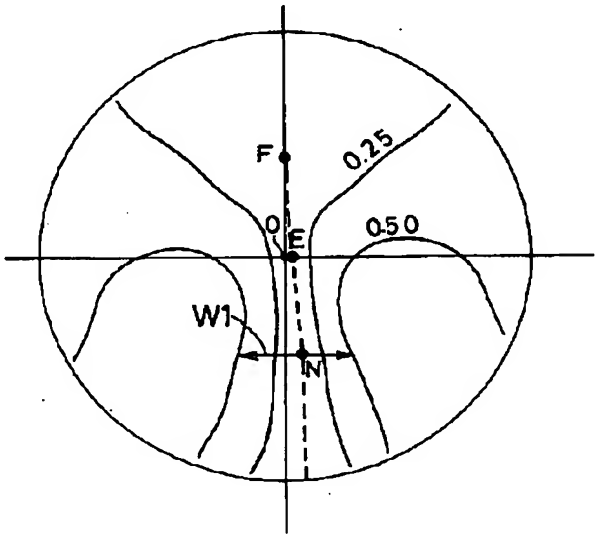
(54)【発明の名称】　累進多焦点レンズ

(57)【要約】
【課題】　全体に揺れの少ない累進多焦点レンズを提供する。
【解決手段】　加入度が少なくとも０．７５ジオプターから３．００ジオプターの範囲を備え、近用度数測定位置Ｎを通る水平方向の断面曲線に沿っての非点収差の値がＸジオプター以下の領域の幅をＷ（Ｄｉ，Ｘ）ｍｍとするとき、該加入度（Ｄｉ）がそれぞれ　Ｄａ ジオプター，Ｄｂ ジオプターで示されるＡ，Ｂの２種類のレンズの関係において、該加入度（Ｄｉ）がＤａ＞Ｄｂ　のとき、
Ｗ（Ｄａ，Ｘ）＞Ｗ（Ｄｂ，Ｘ・Ｄｂ／Ｄａ）
（但し、Ｘ＝　１．００　ジオプターとする。）



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【特許請求の範囲】

【請求項１】　遠用度数測定位置Ｆと近用度数測定位置Ｎとレンズ装用者が正面視をしたときに視線の通過するアイポイント位置（視野位置）Ｅとが予め設定されている累進多焦点レンズであって、遠用度数測定位置Ｆに対する近用度数測定位置Ｎの付加表面屈折力を加入度（Ｄｉ）とするとき、該レンズは前記加入度（Ｄｉ）が少なくとも０．７５ジオプターから３．００ジオプターの範囲を備え、近用度数測定位置Ｎを通る水平方向の断面曲線に沿っての非点収差の値がＸジオプター以下の領域の幅をＷ（Ｄｉ，Ｘ）ｍｍとするとき、　前記加入度（Ｄｉ）がそれぞれＤａ ジオプター，Ｄｂ ジオプターで示されるＡ，Ｂの２種類のレンズの関係において、

前記加入度（Ｄｉ）がＤａ ＞Ｄｂ　のとき、

Ｗ（Ｄａ，Ｘ）＞Ｗ（Ｄｂ，Ｘ・Ｄｂ／Ｄａ）

（ただし、Ｘ＝１．００　ジオプターとする。）の関係を満足することを特徴とする累進多焦点レンズ。

【請求項２】　請求項１に記載の累進多焦点レンズにおいて、

前記遠用度数測定位置Ｆ、アイポイント位置Ｅ及び近用度数測定位置Ｎの３点を通る一本の曲線を主注視線とするとき、該主注視線上の任意の点Ｐの、遠用度数測定位置Ｆを基準とした水平方向鼻側への偏位量Ｈが、Ｈ＝Ｋ・Ｄｐ／Ｄｉ で表されることを特徴とする累進多焦点レンズ。（ただし、Ｋは、１．０≦Ｋ≦４．０である任意の定数、Ｄｐ は点Ｐにおける付加表面屈折力、Ｄｉ は加入度である。）

【請求項３】　請求項１又は２に記載の累進多焦点レンズにおいて、

前記主注視線上における任意の点Ｐは遠用度数測定位置Ｆ及び近用度数測定位置Ｎを除いて、２つの主曲率が異なる部分を有することを特徴とする累進多焦点レンズ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、優れた視機能を有する累進多焦点レンズに関する。

【０００２】

【従来の技術】一般に累進多焦点レンズには「遠用部」と呼ばれる遠方を見る為の領域と、「中間部」と呼ばれる中間距離を見る為の領域と、「近用部」と呼ばれる近方を見る為の領域が存在する。なお、ここでいう中間距離とは概ね５０ｃｍから２ｍまでの距離を指し、これより遠い距離を遠方、近い距離を近方と呼んでいる。しかしながら時には遠方とは無限遠方のみを意味したり、近方とは３０ｃｍ乃至３３ｃｍを指すこともあって、確たる定義が存在していないのが実情である。元来累進多焦点レンズには、外目からそれと判る明瞭な境界線が存在しないのであるから、これらの定義が確定していなくとも実際の装用上に不都合は無い。

【０００３】しかしながら、レンズの設計や製造、検

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査、更には枠入れする際にはレンズ上に基準となるいくつかの正確に定義された点が必要となる。それらの点のうち、現在最も一般的なものに遠用度数測定位置Ｆ、近用度数測定位置Ｎ、それにレンズの装用者が正面視をしたときに視線の通過する位置Ｅ（本明細書では、フィッティングポイントも含めて、以下、アイポイント位置という。）の３つがあり、通常、未加工の状態では、レンズの光学レイアウト情報としてレンズ表面に表示されている。

【０００４】遠用度数測定位置Ｆや近用度数測定位置Ｎの位置を定めることは、ＩＳＯやＪＩＳで定められた規格の検証にとって必須であり、また、アイポイント位置Ｅはレンズの枠入れをする際の垂直方向や水平方向を定めるのに使用されたり、あるいは、幾何学中心点Ｇに一致させてたりして使用する場合がある。

【０００５】この他にも、例えばレンズのプリズム屈折力の測定位置Ｑ等がこれらレンズの光学情報を知るうえでも必須である。

【０００６】また、累進変化の起点位置や終点位置も重要なレンズ情報を示す位置ではあるが、レンズ表面上に表示義務が無く、実測による特定も困難である場合が多い。

【０００７】さらに、遠用度数測定位置Ｆや近用度数測定位置Ｎはこれら累進変化の起点位置や終点位置から、レンズメーター開口部の半径に相当する距離（２～４ｍｍ程度）だけ上方及び下方にずれて位置している場合が多い。

【０００８】さて、累進多焦点レンズに存在する不可避の欠点として非点収差の存在があげられる。この非点収差の発生原因は、遠用度数測定位置Ｆと近用度数測定位置Ｎとの２点における表面屈折力差として定義されている加入度（Ｄｉ）の存在である。更に詳しく述べるならば、遠用度数測定位置Ｆから近用度数測定位置Ｎに至るレンズ表面の曲率変化が生み出す曲面の捩れ（歪み）が非点収差を生み出している。従って非点収差を減らす為には加入度の値を減らすか、遠用度数測定位置Ｆと近用度数測定位置Ｎとの距離を伸ばせば良い（厳密には表面屈折力の変化率を減らせば良い）ことになる。ところが加入度の値は近見時に必要な付加屈折力であるから、これを減らせば累進多焦点レンズ本来の目的が達成できない。また、遠用度数測定位置Ｆと近用度数測定位置Ｎとの距離を伸ばすために、遠用度数測定位置Ｆを変えずに近用度数測定位置Ｎを下げると近方視において視線を大きく下方に転じなければならず不便である。

【０００９】非点収差による違和感をできるだけ少なくして装用感の向上を図った試みとして、特開昭６２－１０６１７号では、遠方の視野を犠牲にして非点収差を減らし、中間視及び近方視を重視した累進多焦点レンズが提案されている。この提案の累進多焦点レンズでは、累進帯長が２０ミリ以上に設定されている。

【００１０】

【発明が解決しようとする課題】しかし、累進多焦点レンズを更に使い易くするために、加齢と共により大きな加入度（Ｄｉ）の累進レンズが必要となることに鑑み、加入度（Ｄｉ）が大きくなった場合に生じる問題点についての対策も考慮しなければならない。

【００１１】すなわち、加入度（Ｄｉ）が比較的小さい装用者は比較的若いので視生活が活発であり、頭部や視線を大きく動かしたときの視野（動的視野）の安定が要求され、逆に加入度（Ｄｉ）が比較的大きい装用者は比較的高齢なので静かな視生活であり、頭部や視線をあまり大きく動かさないときの視野（静的視野）の安定が要求される。従って加入度（Ｄｉ）の値によって設計そのもの、即ち、累進多焦点レンズ上の非点収差やその軸方向、平均度数（球面度数＋乱視度数の１／２）、更にはレンズのプリズム屈折力の水平成分や垂直成分の分布を、上記要求に合わせるべく変えることが望ましい。

【００１２】また、前記特開昭６２－１０６１７号に開示されている累進多焦点レンズは、中間視及び近方視を重視した設計としたため、表面非点収差が０．５０ジオプター以下の遠用明視域の横幅が、わずか３０mm以下にすぎないため装用者が無意識のうちに遠用を見たとき「視野の狭窄感」が強く働きやすいという課題を残してしている。本発明は上述の背景のもとでなされたものであり、優れた視野域を有する累進多焦点レンズを提供することを目的とする。

【００１３】

【課題を解決するための手段】上述の課題を解決するための手段として、第１の手段は、遠用度数測定位置Ｆと近用度数測定位置Ｎとレンズ装用者が正面視をしたときに視線の通過するアイポイント位置（視野位置）Ｅとが予め設定されている累進多焦点レンズであって、遠用度数測定位置Ｆに対する近用度数測定位置Ｎの付加表面屈折力を加入度（Ｄｉ）とするとき、該レンズは前記加入度（Ｄｉ）が少なくとも０．７５ジオプターから３．００ジオプターの範囲を備え、近用度数測定位置Ｎを通る水平方向の断面曲線に沿っての非点収差の値がＸジオプター以下の領域の幅をＷ（Ｄｉ，Ｘ）mmとするとき、前記加入度（Ｄｉ）がそれぞれDaジオプター，Db ジオプターで示されるＡ，Ｂの２種類のレンズの関係において、前記加入度（Ｄｉ）がDa ＞Db　のとき、

Ｗ（Da，Ｘ）＞Ｗ（Db，Ｘ・Db ／Da）

（ただし、Ｘ＝１．００　ジオプターとする。）の関係を満足することを特徴とする累進多焦点レンズである。第２の手段は、第１の手段にかかる累進多焦点レンズにおいて、前記遠用度数測定位置Ｆ、アイポイント位置Ｅ及び近用度数測定位置Ｎの３点を通る一本の曲線を主注視線とするとき、該主注視線上の任意の点Ｐの、遠用度数測定位置Ｆを基準とした水平方向鼻側への偏位量Ｈが、Ｈ＝Ｋ・Dp ／Ｄｉ で表されることを特徴とする累進多焦点レンズである。（ただし、Ｋは、１．０≦Ｋ≦４．０である任意の定数、Dp は点Ｐにおける付加表面屈折力、Ｄｉ は加入度である。）第３の手段は、第１又は第２の手段にかかる累進多焦点レンズにおいて、前記主注視線上における任意の点Ｐは遠用度数測定位置Ｆ及び近用度数測定位置Ｎを除いて、２つの主曲率が異なる部分を有することを特徴とする累進多焦点レンズである。さらに、他の手段としては、遠用度数測定位置Ｆと近用度数測定位置Ｎとレンズ装用者が正面視をしたときに視線の通過するアイポイント位置Ｅとが予め設定されている累進多焦点レンズであって、遠用度数測定位置Ｆに対する近用度数測定位置Ｎの付加表面屈折力を加入度（Ｄｉ）とするとき、該レンズは次の（イ）から（ホ）の条件を備えていることを特徴とする累進多焦点レンズである。

（イ）アイポイント位置Ｅにおける付加表面屈折力は加入度（Ｄｉ）の３０％以上５０％以下であること。

（ロ）該レンズにはレンズ全表面を２分する対称軸が存在せず、右眼用レンズと左眼用レンズとは相異なる屈折表面を有していること。

（ハ）該レンズは右眼用左眼用共、近見時の眼の輻輳作用に対応させるべく、アイポイント位置Ｅは遠用度数測定位置Ｆの位置よりも鼻側に偏位し、近用度数測定位置Ｎはアイポイント位置Ｅよりも更に鼻側に偏位していること。

（ニ）遠用度数測定位置Ｆはアイポイント位置Ｅよりも１０mm乃至１７mm上方に偏位し、近用度数測定位置Ｎはアイポイント位置Ｅよりも１４mm乃至２１mm下方に偏位していること。

（ホ）該レンズ上の遠用度数測定位置Ｆを中心として水平側を０°の基準方向としたとき、３０°方向から１５０°方向に至る略扇形の領域を遠用明視域とし、該遠用明視域における非点収差量は加入度（Ｄｉ）の値にかかわらず０．５０ジオプター以下であること。

さらに他の手段としては、上記他の手段にかかる累進多焦点レンズにおいて、前記主注視線上の任意の点Ｐと交差する水平方向の断面曲線に沿っての光学的状況の変化は、該主注視線が遠用度数測定位置Ｆを基準として水平方向に偏位していない部分では点Ｐを境に左右鏡面対称であり、該主注視線が遠用度数測定位置Ｆを基準として鼻側へ偏位している部分では点Ｐから鼻側に至る変化の方が耳側に至る変化よりも激しいことを特徴とする累進多焦点レンズである。

【００１４】

【作用】上述の手段によれば、優れた視野域を有する累進多焦点レンズを得ることが可能になった。また、同時に中間視及び近方視を重視した設計を採用することもできる。以下、上記手段の作用を詳しく説明する。

【００１５】上述の第１の手段にかかる累進多焦点レンズにおいては、加齢と共により大きな加入度（Ｄｉ）の

累進レンズが必要となることに鑑み、加入度（Ｄｉ）が大きくなった場合に生じる問題点についての対策を考慮した。

【００１６】すなわち、加入度（Ｄｉ）が比較的小さい装用者は比較的若いので視生活が活発であり、頭部や視線を大きく動かしたときの視野（動的視野）の安定が要求され、逆に加入度（Ｄｉ）が比較的大きい装用者は比較的高齢なので静かな視生活であり、頭部や視線をあまり大きく動かさないときの視野（静的視野）の安定が要求される。従って加入度（Ｄｉ）の値によって設計そのもの、即ち、累進多焦点レンズ上の非点収差やその軸方向、平均度数（球面度数＋乱視度数の１／２）、更にはレンズのプリズム屈折力の水平成分や垂直成分の分布を、上記要求に合わせるべく変えることが望ましい。

【００１７】また、独自に行なった装用テストの結果、近方視における明視域の限界非点収差量と加入度（Ｄｉ）との相関は殆ど認められれず、約０．７５乃至１．００ジオプター以内の非点収差であれば明視しうることが判明した。従って、従来のようにいかなる加入度（Ｄｉ）の値に対しても同一の設計であれば、加入度（Ｄｉ）が大きくなったとき近用明視域が狭くなる傾向から逃れられないが、加入度（Ｄｉ）が大きくなる程、近用明視域として約１．００ジオプター以内の非点収差の幅Ｗをより広くする設計に変えれば、上記の傾向を緩和出来ることになる。

【００１８】以上の点をまとめると、例えば、加入度（Ｄｉ）が０．２５ジオプターから５．００ジオプター、少なくとも０．７５ジオプターから３．００ジオプターの範囲を備え、近用度数測定位置Ｎを通る水平方向の断面曲線に沿っての非点収差の値がＸジオプター以下の領域の幅をＷ（Ｄｉ，Ｘ）ｍｍとするとき、該加入度（Ｄｉ）がそれぞれ　Ｄａ ジオプター，Ｄｂ ジオプターで示されるＡ，Ｂの２種類のレンズの関係において、該加入度（Ｄｉ）がＤａ＞Ｄｂ　のとき、

Ｗ（Ｄａ，Ｘ）＞Ｗ（Ｄｂ，Ｘ・Ｄｂ／Ｄａ）

（但し、Ｘ＝　１．００　ジオプターとする。）とすれば加入度（Ｄｉ）が大きくなったとき、近用明視域が狭くなる傾向を緩和することができることになる。

【００１９】ただし、加入度（Ｄｉ）が大きくなったとき、近用領域での非点収差を減らすと近用側方の非点収差が増大するので、静的視野はより安定するが動的視野は不安定となる。即ち、比較的小さい加入度を有する累進多焦点レンズに動的視野を安定させる設計を施し、比較的大きい加入度を有する累進多焦点レンズに上記の方法を適用すれば、比較的大きい加入度を有する累進多焦点レンズの静的視野が安定することとなり、前述の要求をも同時に満足させることになる。

【００２０】また、第２の手段においては、第１の手段にかかる累進多焦点レンズを更に使い易くするために、前記遠用度数測定位置Ｆとアイポイント位置Ｅ、及び近用度数測定位置Ｎの３点を通る一本の曲線を想定し、注視するときの視線の通過頻度が最も高いという意味で主注視線と名付け、この主注視線上の任意の点Ｐの、遠用度数測定位置Ｆの位置を基準とした水平方向鼻側への偏位量ＨはＫを１．０≦Ｋ≦４．０である任意の定数、点Ｐにおける付加表面屈折力をＤｐ、加入度をＤｉとしたとき、

Ｈ＝Ｋ・Ｄｐ／Ｄｉ

で表されるとして主注視線のレンズ上の位置を定めた。

【００２１】主注視線に沿って付加表面屈折力を増やしてあるのは、より近い距離の視標を見るためであり、より近い距離の視標を見るということは左右眼の視線が相互に更に鼻側に寄る（眼の輻輳作用が増える）ということであるから、それに対応させる為には主注視線の鼻側への偏位量を増やす必要がある。従って、主注視線上の任意の点Ｐの偏位量Ｈは点Ｐにおける付加表面屈折力Ｄｐ をＤｉ で割った値に比例する。又、任意の定数Ｋの値に幅を持たせたのは、偏位量Ｈの位置におけるレンズの透過屈折力の水平方向成分によるプリズム作用のため、視線がレンズを通過する際に屈折し、前記透過屈折力が負の場合Ｋは小さくなり、正の場合Ｋは大きくなるからである。透過屈折力が０の場合には、Ｋ＝２．５程度の値が望ましい。

【００２２】第３の手段は、第１又は第２の手段にかかる累進多焦点レンズを更に使い易くするために、前記主注視線上における任意の点Ｐは遠用度数測定位置Ｆ及び近用度数測定位置Ｎを除いて、２つの主曲率が異なる部分を有することとした。

【００２３】これまで使用してきた光学的状況の項目として、累進多焦点レンズ上の非点収差やその軸方向、平均度数（球面度数＋乱視度数の１／２）、更にはレンズのプリズム屈折力の水平成分や垂直成分の分布等がある。これらは説明を容易とするために、主として累進多焦点レンズ表面の状態として扱ってきた。即ち、非点収差とは累進表面の表面非点収差の事であり、平均度数とは累進表面の表面平均度数のことであり、更にプリズム屈折力とは累進表面と裏面の法線方向の差等から比較的単純に算出される値であった。

【００２４】しかしながら現実のレンズは眼鏡枠に枠入れされて眼前約１２ｍｍの位置に５°乃至１０°程度の前傾状態で装用されるのであるから、実際には視線がレンズと交わる角度やその位置での厚み（厳密にはレンズ内での視線の光路長）等が全て関係しているのは自明であるから、上記の非点収差とは透過非点収差、平均度数とは透過平均度数、更にプリズム屈折力とは視線のふれ角から算出されるべき値としてとらえても本発明の技術的範囲に含まれる（加入度の表現のみ、特に「付加表面屈折力」としたのは、それが加入度の定義だからである。）。従って、前記主注視線の説明として、従来よく用いられている「表面非点収差の無い線（＝へそ状子午

線）」としていないのは、表面非点収差の無いことが実際の使用状況において必ずしも最良の状態ではないことから本発明の必須要件としていないからである。

【００２５】本発明者等の研究によれば、一般的な累進多焦点レンズにおける「遠用部」「中間部」「近用部」の明視しうる領域の広さの配分は、個々の累進多焦点レンズの種類により多少の違いはあるが「遠用部」が最も広くなっている。これは日常生活において遠方視の頻度が極めて高いことに対応させているからである。また、非点収差に対する人間の眼の感度も、遠方視が最も敏感であり、中間視から近方視に移るにつれ鈍くなっていく傾向が認められる。

【００２６】独自に行なった装用テストの結果を見ても、遠方視における明視域は約０．５０ジオプター以内の非点収差であることを必要とするが、近方視では約０．７５乃至１．００ジオプター以内の非点収差であれば明視しうることが判明している。従ってある一定の非点収差の値で各明視域の広さを単純比較することは合理的ではないと判断される。 さらに、人間にとって遠方の視野が狭められるということは心理的に大きな負担となる。これは単に「便利か不便か」といった問題ではなく、「視野の狭窄感」という心理的圧迫が装用者をしてその眼鏡を忌避させる要因となるということである。

【００２７】かかる状況に鑑み、上述の他の手段にかかる累進多焦点レンズでは、遠用明視域は前記Ｆの位置を基準にして３０°方向から１５０°方向に至る略扇形の大きく上方に開いた末広がりの領域と定義し、この遠用明視域における非点収差は加入度（Ｄｉ）の値にかかわらず０．５０ジオプター以下とした。加入度（Ｄｉ）の値に無関係に限界値を定めたのは、独自に行なった装用テストの結果、遠方視における明視域の限界非点収差量に加入度（Ｄｉ）との相関が殆ど認められなかったからである。

【００２８】また、遠用明視域の形状を上記の様に「略扇形の大きく上方に開いた末広がりの領域」と定めたのは、装用者に「視野の狭窄感」を抱かせないためである。さらに、他の手段にかかる累進多焦点レンズの装用者が正面視をしたときに視線の通過するアイポイント位置Ｅを中間距離を見るのに適した状態にする為に、アイポイント位置Ｅにおける付加表面屈折力を、加入度（Ｄｉ）の３０％以上５０％以下とした。これは、多くの装用テストにより、３０％未満では遠用度数測定位置Ｅから近用度数測定位置Ｎまでの表面屈折力の変化が激しくなり中間視野側方の非点収差を充分に減少させることが出来ず、又、５０％を越えては遠用明視域を充分に確保出来ないことが判明したからである。

【００２９】また、他の手段にかかる累進多焦点レンズでは通常の累進多焦点レンズよりも非点収差を充分に減少させてあるがために側方を広く使用することになるので、特に側方における両眼視を良好にする必要がある。従って、レンズ全表面を２分する対称軸が存在し、枠入れ時に５°乃至１０°回転させる、いわゆる「左右対称型設計」は、側方における両眼視を全く考慮していないため好ましくなく、右眼用レンズと左眼用レンズとが相異なる表面を有した、いわゆる「左右別型設計」を最適と位置づける。

【００３０】さらに、前記遠用度数測定位置Ｆ，アイポイント位置Ｅ，近用度数測定位置Ｎの３点の水平方向の配置については、右眼用左眼用共、近見時の眼の輻輳作用に対応させるべく、アイポイント位置Ｅの位置は遠用度数測定位置Ｆの位置よりも鼻側に偏位しており、近用度数測定位置Ｎの位置はアイポイント位置Ｅの位置よりも更に鼻側に偏位していることが必要である。

【００３１】また、これら３点の縦方向の配置として、多くの装用テストにより遠用度数測定位置Ｆの位置はアイポイント位置Ｅの位置よりも好ましくは１０mm乃至１７mm、より好ましくは、１２mm乃至１５mm上方に偏位させ、近用度数測定位置Ｎの位置はアイポイント位置Ｅよりも好ましくは１４mm乃至２１mm、より好ましくは、１６mm乃至１９mm下方に偏位させることが、遠用度数測定位置Ｆと近用度数測定位置Ｎとの距離を充分にとって屈折力変化を減少しうると同時に、遠近２つの領域への無理のない視線移動をするための最適な両立範囲であることが判明した。

【００３２】また、上記他の手段にかかる累進多焦点レンズを更に使い易くするために、前述した「左右別型設計」の内容を次に示す技術とすることにより更に改良することができる。すなわち、良好な両眼視を得るためには、視線が通過するレンズ上の非点収差やその軸方向、平均度数（球面度数＋乱視度数の１／２）、さらにはレンズのプリズム屈折力の水平成分や垂直成分を、左右眼で一致させることが必要となる。ここにおいて、見ようとする視標がレンズ装用者の正面にある場合は前述の主注視線の配置や表面屈折力の配分を考慮するだけで事足りる。

【００３３】ところが、見ようとする視標がレンズ装用者の側方に移った場合は、片眼の視線が耳側に移動し他眼の視線が鼻側に移動するので、両方の視線が通過するレンズ上の光学的状況が同じになるとは限らない。 仮に、見ようとする視標がレンズ装用者の無限遠方であれば、正面視から側方視に移るときに左右眼の視線のふれる角度は同じになるから、レンズ上の光学的状況の分布は前述の主注視線を境に水平方向に左右鏡面対称（主注視線の位置に鏡を置いて写した様な対称配置を意味し、単なる「左右対称」の意味ではない。

【００３４】これは、非点収差の軸方向の様に方向性のあるものをも前述の「光学的状況」に含まれるようにするためである。）となっていることが望ましい。 一方、見ようとする視標がレンズ装用者の有限距離であれば、眼の輻輳作用により左右眼の視線は相互に鼻側に寄

っている。この状態で正面視から側方視に移るとき、視標までの距離が不変ならば、左右眼の視線のふれる角度は同じになる。ところが、ごく近方を例にとって考えればすぐに判る様に正面視から側方視に移るとき、視標までの距離は遠ざかるのが普通である。そうなれば眼の輻輳作用が弱まり、両眼の視線は平行に近くなる。

【００３５】従って、見ようとする視標がレンズ装用者の有限距離にあれば、正面視から側方視に移るときに左右眼の視線のふれる角度が異なり、耳側に移動する視線の方が、鼻側に移動する視線よりも大きい。この傾向は側方視に於ける頭部の回転（通常は正面視から側方視に移る角度の約半分を頭部が回転し、残りを眼球が回転する。）のために、頭部と付随して回転する眼鏡レンズ上では一層凝縮され、顕著となる。このため有限距離を見るために、主注視線が前記Ｆの位置を基準として鼻側に偏位している部分では、水平方向に左右非対称となっていることが望ましい。

【００３６】累進多焦点レンズでは主注視線から水平方向へのレンズ上の光学的状況の分布は変化しているのが普通であるから、左右の視線が通過するレンズ上の光学的状況を同じにするためには、主注視線から鼻側に至る変化の方が耳側に至る変化よりも激しくなっていることが望ましい。

【００３７】以上の点をまとめると、前記主注視線上の任意の点Ｐと交差する水平方向の断面曲線に沿っての非点収差の変化、非点収差の軸方向の変化、平均屈折力の変化、プリズム屈折力の水平成分の変化、プリズム屈折力の垂直成分の変化等の光学的状況の少なくとも１つは遠用度数測定位置Ｆの位置を基準として水平方向に偏位していない部分では点Ｐを境に左右鏡面対称とし、遠用度数測定位置Ｆの位置を基準として鼻側へ偏位している部分では点Ｐから鼻側に至る変化の方が耳側に至る変化よりも激しくなっていることが望ましいということになる。

【００３８】

【発明の実施の形態】（実施例１）図１は本実施例１の右眼用累進多焦点レンズの光学情報のレイアウトを説明する図である。 図１において、レンズの幾何中心Ｏの上方１４ｍｍの位置に遠用度数測定位置Ｆ、レンズの幾何中心Ｏの下方１７．５ｍｍかつ鼻側内方２．５ｍｍの位置に近用度数測定位置Ｎ、レンズの幾何中心の水平方向鼻側１．０ｍｍの位置にレンズの装用者が正面視をしたときに視線の通過する位置Ｅが存在する（図は説明上、やや誇張的に描かれている）。

【００３９】本実施例において遠用度数は　Ｓ－１．００ジオプター、加入度は　Ｄｉ＝＋２．００ジオプターである。遠用度数測定位置Ｅにおける付加表面屈折力は＋０．７６ジオプターであり、これは加入度（Ｄｉ）の約３８％に相当する。レンズ上の遠用度数測定位置Ｆの位置を中心として水平右側を０°の基準方向としたとき、３０°方向から１５０°方向に至る略扇形の領域Ｄｆは遠用明視域であり、この領域における非点収差は０．５０ジオプター以下である。

【００４０】図１のレンズのほぼ中央縦方向にある一本の太い曲線は主注視線であり、遠用度数測定位置Ｆとアイポイント位置Ｅ、及び近用度数測定位置Ｎの３点を通ってレンズを「鼻側部分」と「耳側部分」に分割しているが、この２つの面部分は水平方向に非対称である。

【００４１】この主注視線上の任意の点Ｐにおける偏位量Ｈを示す図が図２であり、この主注視線上の任意の点Ｐにおける付加表面屈折力Ｄを示す図が図３である。図２と図３における横座標は正の数値がレンズの幾何中心点から上方、負の数値が下方の位置を表している。一見してわかるように、図２と図３におけるグラフの形状は似かよっており、異なるのは縦座標のみである。これはＨとＤとに、Ｈ＝Ｋ・Ｄ／Ｄｉなる正比例の関係があるからであり、ここでＫは２．５という定数である。

【００４２】（実施例２）図４は本実施例２の右眼用累進多焦点レンズの光学情報のレイアウトを説明する図である。 図４において、レンズの幾何中心の上方１４ｍｍ水平方向耳側１．０ｍｍの位置に遠用度数測定位置Ｆ、レンズの幾何中心の下方１７．５ｍｍかつ鼻側内方１．５ｍｍの位置に近用度数測定位置Ｎ、レンズの幾何中心の位置にレンズの装用者が正面視をしたときに視線の通過する位置Ｅが存在する。

【００４３】この実施例は、図１に示される実施例１における遠用度数測定位置Ｆ、アイポイント位置Ｅ及び近用度数測定位置Ｎの３点を共に水平方向耳側へ１．０ｍｍだけ偏位させた配置となっている。その他は実施例１の累進多焦点レンズと同一である。

【００４４】この実施例２のレンズの実施例１のレンズに対する利点は、アイポイント位置Ｅを裏面加工上の中心点と一致させ、プリズム屈折力の測定点とすることが容易にできることにある。

【００４５】（実施例３）図５及び図６は実施例３の累進多焦点レンズの非点収差分布を示す図である。ここで、図５は加入度数Ｄａ＝＋１．００ジオプター、図６は加入度数Ｄｂ＝＋２．００ジオプターの２つの累進多焦点レンズの実施例にそれぞれ対応しており、各々に描かれた曲線（実線）は０．２５ジオプター毎の非点収差の等高線であって、各々の曲線の傍らに記された数値は非点収差量（単位：ジオプター）を表している。

【００４６】図５及び図６のそれぞれに記された遠用度数測定位置Ｆ，アイポイント位置Ｅ，近用度数測定位置Ｎは実施例１と同じ配置であり、レンズのほぼ中央縦方向にある一本の曲線（点線）は主注視線であり、遠用度数測定位置Ｆとアイポイント位置Ｅ、及び近用度数測定位置Ｎの３点を通っている。各々に描かれた非点収差の等高線の間隔のうち、主注視線が遠用度数測定位置Ｆの位置を基準として水平方向に偏位していない部分（遠用

度数測定位置Ｆより上部）では左右鏡面対称であり、主注視線が遠用度数測定位置Ｆの位置を基準として鼻側へ偏位している部分（遠用度数測定位置Ｆより下部）では、「鼻側部分（向かって右側）」が「密」、「耳側部分（向かって左側）」が「疎」であって、主注視線から鼻側に至る変化の方が耳側に至る変化よりも激しくなっている。この特徴は非点収差ばかりではなく、非点収差の軸方向、平均屈折力、プリズム屈折力の水平成分と垂直成分においても同様である。

【００４７】また、近用度数測定位置Ｎを通る水平方向の断面曲線に沿っての非点収差の値がＸジオプター以下の領域の幅をＷ（Ｄｉ，Ｘ）ｍｍとするとき、加入度（Ｄｉ）がそれぞれ　Ｄａ ジオプター，Ｄｂ ジオプターで示されるＡ，Ｂの２種類のレンズの関係において、加入度（Ｄｉ）がＤａ ＞Ｄｂ　のとき、

Ｗ（Ｄａ，Ｘ）＞Ｗ（Ｄｂ，Ｘ・Ｄｂ／Ｄａ）

（ただし、Ｘ＝１．００　ジオプターとする）の関係を満たしている。

【００４８】従って、図５の近用部Ｗ１は、Ｗ１＝Ｗ（１．００，０．５０）、図６の近用部Ｗ２は、Ｗ２＝Ｗ（２．００，１．００）と表される。それゆえ、図５のレンズは、図６のレンズの２倍の加入度なのであるから、図５のレンズと図６のレンズとが同一の設計であるならば、図６のレンズは図５のレンズを２枚重ねたものに等しくなるはずである。すなわち、加入度Ｄｂ ＝＋２．００ジオプターにおける非点収差量１．００ジオプターの幅（Ｗ２）は、加入度Ｄａ ＝＋１．００ジオプターにおける非点収差量０．５０ジオプターの幅（Ｗ１）に等しくなるはずである。

【００４９】ところが、図５のレンズと図６のレンズとにおいて、Ｎを通る水平方向の２つの矢印の幅を比較するとＷ２＞Ｗ１，即ち、Ｗ（２．００，１．００）＞Ｗ（１．００，０．５０）となっており、加入度が大きくなったとき、近用明視域が狭くなる傾向を緩和する設計をしていることが判る。

【００５０】（実施例４）図７は実施例４の右眼用累進多焦点レンズの非点収差分布を示す図である。本実施例において遠用度数は、Ｓ＋１．５０ジオプター、加入度数は、Ｄｉ ＝＋２．００ジオプターであり、曲線（実線）は０．２５ジオプター毎の非点収差の等高線であって、各々の曲線の傍らに記された数値は非点収差量（単位：ジオプター）を表している。

【００５１】レンズの幾何中心Ｏの上方１５ｍｍの位置に遠用度数測定位置Ｆ、レンズの幾何中心Ｏの下方１９ｍｍかつ鼻側内方２．５ｍｍの位置に近用度数測定位置Ｎ、レンズの幾何中心Ｏの水平方向鼻側１．０ｍｍの位置にレンズの装用者が正面視をしたときに視線の通過する位置Ｅが存在する。レンズのほぼ中央縦方向にある一本の曲線（点線）は主注視線であり、遠用度数測定位置ＦとアイポイントＥ、及び近用度数測定位置Ｎの３点を通っている。この主注視線の下方には非点収差の等高線と交差している部分があり、この主注視線に沿っての各点における２つの主曲率が異なる部分がレンズ下方に存在していることが判る。

【００５２】この実施例では、レンズは眼鏡枠に枠入れされて眼前約１２ｍｍの位置に７°前傾状態で装用されるとの想定の下に、全ての視線の方向に対して、視線がレンズと交わる角度やその位置でのレンズ内での視線の光路長等を考慮して、透過非点収差の分布、透過平均度数の分布、更には視線のふれ角の分布等がより望ましい状態になるようにレンズ表面を設定した。その結果、主注視線に沿っての各点における２つの主曲率が異なる部分が生じたのである。しかしながら、前記ＦとＮの位置のみは検査工程の都合上、２つの主曲率を等しく設定した。

【００５３】

【発明の効果】以上詳述したように、本発明にかかる累進多焦点レンズは、優れた視野機能を有し、側方の像の揺れの少なく、かつ、遠用、近用、中間のバランスのとれた視野域を有する累進多焦点レンズを備えるものである。

【図面の簡単な説明】

【図１】本発明の実施例１の右眼用累進多焦点レンズの光学情報のレイアウトを説明する図である。

【図２】本発明の実施例１の右眼用累進多焦点レンズの主注視線上の任意の点Ｐにおける偏位量Ｈを示す図である。

【図３】本発明の実施例１の右眼用累進多焦点レンズの主注視線上の任意の点Ｐにおける付加表面屈折力Ｄを示す図である。

【図４】本発明の実施例２の右眼用累進多焦点レンズの光学情報のレイアウトを説明する図である。

【図５】本発明の実施例３の右眼用累進多焦点レンズの非点収差分布を示す図である。

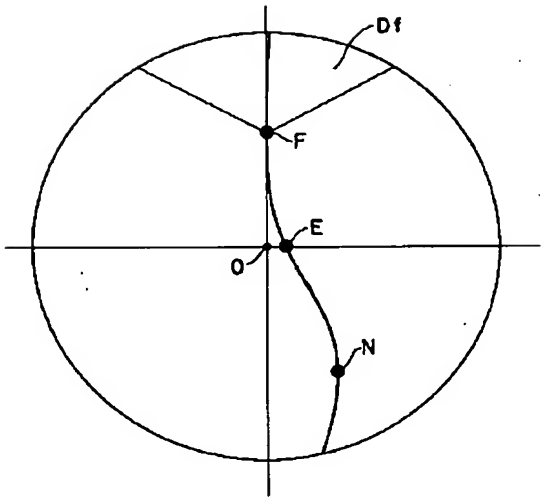
【図６】本発明の実施例３の右眼用累進多焦点レンズの非点収差分布を示す図である。

【図７】本発明の実施例４の右眼用累進多焦点レンズの非点収差分布を示す図である。

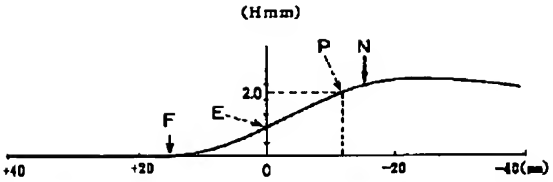
【符号の説明】

Ｅ…アイポイント位置、Ｆ…遠用度数測定位置、Ｎ…近用度数測定位置、Ｄｆ…遠用明視域、Ｏ…レンズの幾何中心。

【図１】

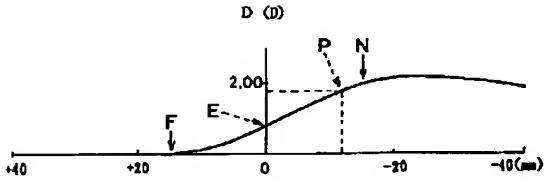


【図２】



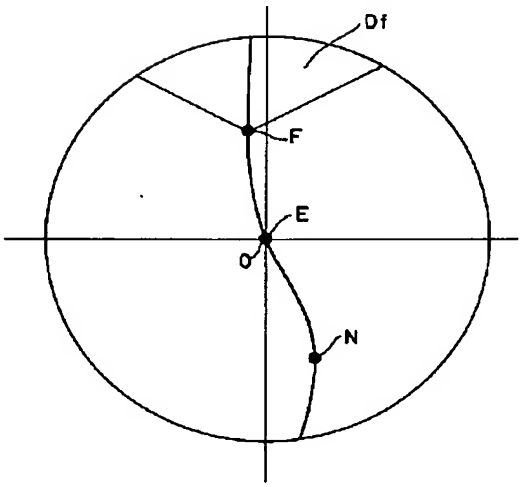
主注視線上の任意の点Pにおける偏位量Hを示す図(ADD=2.00, K=2.5)

【図３】

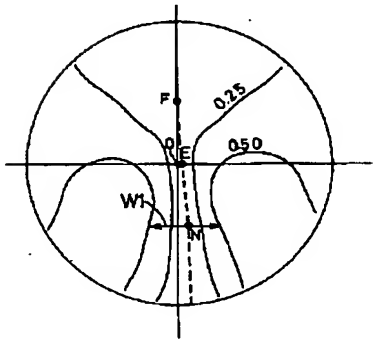


主注視線上の任意の点Pにおける付加表面屈折力Dを示す図(ADD=2.00)

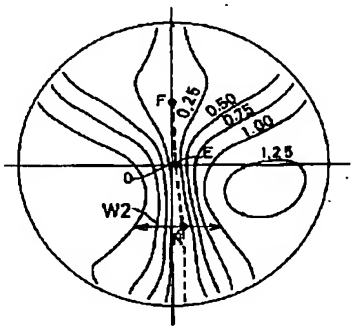
【図４】



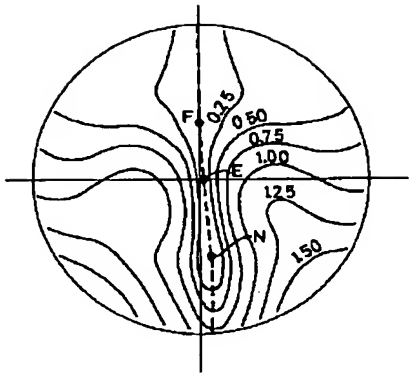
【図５】



【図６】



【図７】



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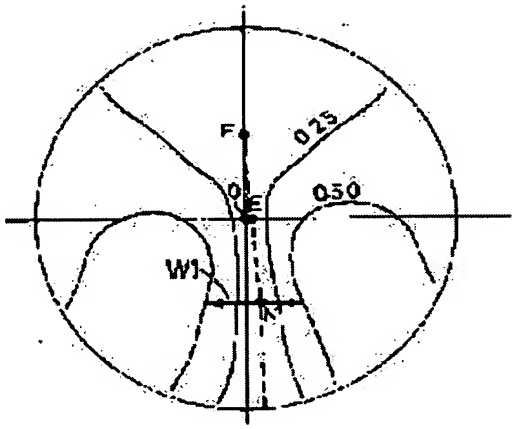
(54) PROGRESSIVE MULTIFOCAL LENS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a progressive multifocal lens with little swinging on the whole.
SOLUTION: When entry power are within a range of the 0.75 to 3.00 diopters, and the width of the area where an astigmatic value along the curved line of the horizontal cross section which passes a measuring point N for a power of near vision is X diopter or less is set to W (Di, X) mm, in the relation of two kinds of lenses A and B of which the entry degree (Di) is shown by Da diopter and Dd diopter, respectively, when the entry degree (Di) is Da>Db, W (Da, X) is ≥W (Db, X.Db/Da), wherein X is 1.00 diopter.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] It is the progressive multifocal lens with which the eye point location (visual field location) E through which a look passes when a lens wearing person considers front view as the frequency measuring point F for ** and the number measuring point N of the Kon supplies is set up beforehand. When considering addition surface refractive power of the number measuring point N of the Kon supplies to the frequency measuring point F for ** as whenever [subscription] (Di), As for this lens, whenever [said subscription] (Di) is equipped with the range of at least 0.75 to 3.00diopter. When the value of the astigmatism in alignment with the horizontal cross-section curve which passes along the **** frequency measuring point N sets width of face of the field below X diopter to W(Di, X) mm, -- whenever [said subscription] -- (Di) respectively -- Da Diopter and Db the relation of two kinds of lenses shown by diopter, A and B, -- setting -- whenever [said subscription] -- (Di) Da >Db it is -- the time -- W(Da, X) >W (Db, X-Db / Da)
(-- however, it considers as X=1.00 diopter.) -- progressive multifocal lens characterized by satisfying relation.
[Claim 2] When making into the main gaze line one curve which passes along three points, said frequency measuring point F for **, the eye point location E, and the number measuring point N of the Kon supplies, in a progressive multifocal lens according to claim 1, The amount H of bias by the side of the horizontal nose on the basis of the frequency measuring point F for ** of the point P of the arbitration on this main gaze line is H=K-Dp/Di. Progressive multifocal lens characterized by what is expressed. (However, the constant of the arbitration whose K is 1.0<=K<=4.0, addition surface refractive power [in / in Dp / Point P], and Di are whenever [subscription].)
[Claim 3] The point P of the arbitration [set to a progressive multifocal lens according to claim 1 or 2, and] on said main gaze line is a progressive multifocal lens characterized by having the part from which two principal curvature differs except for the frequency measuring point F for **, and the number measuring point N of the Kon supplies.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the progressive multifocal lens which has the outstanding visual function.
[0002]
[Description of the Prior Art] Generally the field for seeing the distant place called a "distance point", the field for seeing the middle distance called "pars intermedia", and the field for seeing the method of Kon called a "reading point" exist in a progressive multifocal lens. In addition, a middle distance here points out the distance from 50cm to 2m in general, a far distance is called a distant place from this, and a near distance is called the method of Kon. However, since a distant place sometimes means only the method of infinite distance or the method of Kon points out 30cm thru/or 33cm, the actual condition is that the sure definition does not exist. Since the clear boundary line which turns out to be it from an outside eye does not exist in a progressive multifocal lens originally, even if these definitions are not decided, there is no un-arranging on actual wearing.
[0003] However, the design of a lens, manufacture, inspection, and in case it ****** further, the point defined as some accuracy which serves as criteria on a lens is needed. when the wearing person of a lens make the frequency measuring point F for ** , and the frequency measuring point N for Kon the present most general thing among those points and make front view to it , three of the locations E (henceforth [this specification] an eye point location also including the fitting point) through which a look pass be , and it be usually display on a lens front face as optical layout information on a lens by the raw condition .
[0004] It is indispensable to define the location of the frequency measuring point F for ** and the frequency measuring point N for Kon for verification of the specification defined by ISO or JIS, and it may be used for appointing the perpendicular direction and horizontal direction at the time of carrying out ****** of a lens, or it is made in agreement with the geometrical central point G, is sufficient, and may be used by carrying out the eye point location E.
[0005] In addition, it is indispensable also when the measuring point Q of the prism power of a lens etc. gets to know the optical information of these lenses, for example.
[0006] Moreover, the origin location and terminal point location of progressive change are also a location which shows important lens information, and specification by observation is [there is no display duty on a lens front face, and] also difficult in many cases.
[0007] Furthermore, it shifts caudad and only the distance (about 2-4mm) in which the frequency measuring point F for ** and the frequency measuring point N for Kon are equivalent to the radius of lens meter opening from the origin location and terminal point location of these successive promotion change is located the upper part and often.
[0008] Now, existence of astigmatism is raised as an unescapable fault which exists in a progressive multifocal lens. The cause of generating of this astigmatism is existence of whenever [subscription / which is defined as a surface refractive-power difference in two points of the frequency measuring point

F for ** and the number measuring point N of the Kon supplies] (Di). Furthermore, if it states in detail, the twist (distortion) of the curved surface which the curvature change on the front face of a lens from the frequency measuring point F for ** to the number measuring point N of the Kon supplies produces has produced astigmatism. Therefore, in order to reduce astigmatism, it becomes what to reduce the value of whenever [subscription] or develop the distance of the frequency measuring point F for **, and the number measuring point N of the Kon supplies for (what is necessary is just to reduce the rate of change of surface refractive power strictly). However, since the value which is whenever [subscription] is addition refractive power required at the time of near seeing, if this is reduced, it cannot attain the purpose of progressive multifocal-lens original. Moreover, in order to develop the distance of the frequency measuring point F for **, and the number measuring point N of the Kon supplies, if the number measuring point N of the Kon supplies is lowered without changing the frequency measuring point F for **, in near viewing, a look must be changed caudad greatly, and it is inconvenient.

[0009] As an attempt which lessened the sense of incongruity by astigmatism as much as possible, and aimed at improvement in a feeling of wearing, by JP,62-10617,A, astigmatism is reduced at the sacrifice of a distant visual field, and the progressive multifocal lens which thought the Nakama ** and near viewing as important is proposed. In the progressive multifocal lens of this proposal, progressive band length is set as 20mm or more.

[0010]

[Problem(s) to be Solved by the Invention] However, in order to make a progressive multifocal lens further easy to use, in view of the progressive lens of whenever [bigger subscription / than aging] (Di) being needed, the cure about the trouble produced when whenever [subscription] (Di) becomes large must also be taken into consideration.

[0011] That is, since the wearing person with whenever [subscription / comparatively small] (Di) is comparatively young, ****** is active, the stability of the visual field (dynamic visual field) when moving a head and a look greatly is required, and since the wearing person with whenever [subscription / comparatively large] (Di) is advanced age comparatively, it is quiet ******, and the stability of the visual field (static visual field) when moving neither a head nor a look not much greatly is required conversely. Therefore, it is desirable the design, i.e., the astigmatism and its shaft orientations on a progressive multifocal lens, itself, average frequency (1/2 of number of spherical degrees + astigmatism frequency), and to change it further, with the value of whenever [subscription] (Di), in order to double distribution of the horizontal component of the prism power of a lens or a vertical component with the above-mentioned demand.

[0012] Moreover, the progressive multifocal lens currently indicated by said JP,62-10617,A is written as the design which thought the Nakama ** and near viewing as important, and since surface astigmatism is [the breadth of the clear vision zone for ** of 0.50 or less diopter] only only 30mm or less, when a wearing person looks at the object for ** to the inside of unconscious, it is leaving and carrying out the technical problem that it is easy to commit "the constriction of a visual field" strongly. This invention is made under an above-mentioned background, and it aims at offering the progressive multifocal lens which has the outstanding visual field region.

[0013]

[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, the 1st means It is the progressive multifocal lens with which the eye point location (visual field location) E through which a look passes when a lens wearing person considers front view as the frequency measuring point F for ** and the number measuring point N of the Kon supplies is set up beforehand. When considering addition surface refractive power of the number measuring point N of the Kon supplies to the frequency measuring point F for ** as whenever [subscription] (Di), As for this lens, whenever [said subscription] (Di) is equipped with the range of at least 0.75 to 3.00diopter. When the value of the astigmatism in alignment with the horizontal cross-section curve which passes along the **** frequency measuring point N sets width of face of the field below X diopter to W(Di, X) mm, -- whenever [said subscription] -- (Di) respectively -- Da diopter and Db the relation of two kinds of lenses shown by diopter, A and B, -- setting -- whenever [said subscription] -- (Di) Da >Db it is -- the

time -- W(Da, X) >W (Db, X-Db / Da)
(-- however, it considers as X=1.00 diopter.) -- it is the progressive multifocal lens characterized by satisfying relation. When the 2nd means makes one curve which passes along three points, said frequency measuring point F for **, the eye point location E, and the number measuring point N of the Kon supplies, the main gaze line in the progressive multifocal lens concerning the 1st means, The amount H of bias by the side of the horizontal nose on the basis of the frequency measuring point F for ** of the point P of the arbitration on this main gaze line is H=K-Dp/Di. It is the progressive multifocal lens characterized by what is expressed. (However, the constant of the arbitration whose K is 1.0<=K<=4.0, addition surface refractive power [in / in Dp / Point P], and Di are whenever [subscription].) The 3rd means Setting to the progressive multifocal lens concerning the 1st or 2nd means, the point P of the arbitration on said main gaze line is a progressive multifocal lens characterized by having the part from which two principal curvature differs except for the frequency measuring point F for **, and the number measuring point N of the Kon supplies. Furthermore, it is the progressive multifocal lens with which the eye point location E through which a look passes as other means when a lens wearing person considers front view as the frequency measuring point F for ** and the number measuring point N of the Kon supplies is set up beforehand. When considering addition surface refractive power of the number measuring point N of the Kon supplies to the frequency measuring point F for ** as whenever [subscription] (Di), this lens is a progressive multifocal lens characterized by having the conditions of (e) from the following (b).
(b) The addition surface refractive power in the eye point location E should be whenever [subscription / 50% or less 30% or more of] (Di).
(b) the symmetry axis which makes all lens front faces this lens for 2 minutes -- not existing -- the lens for right eyes, and the lens for left eyes -- difference -- have the refraction front face.
(c) Bias the eye point location E to a nose side rather than the location of the frequency measuring point F for **, and the frequency measuring point N for Kon should be biasing it from the eye point location E to the nose side further so that the object for right eyes for left eyes may make this lens correspond to a congestion operation of the eye at the time of near seeing.
(d) The frequency measuring point F for ** should also bias an eye point location E twist to 10mm thru/or 17mm upper part, and should be biasing the frequency measuring point N for Kon in 14mm thru/or 21mm lower part from the eye point location E.
(e) When you make a horizontal side into a 0-degree reference direction for the frequency measuring point F for ** on this lens as a core, the amount [in / the field of the abbreviation sector which results in the direction of 150 degree from 30 degree is made into the clear vision zone for **, and / this clear vision zone for **] of astigmatism should be 0.50 or less diopter irrespective of the value of whenever [subscription] (Di).
As a means of further others, change of the optical situation of meeting the horizontal cross-section curve which intersects the point P of the arbitration on said main gaze line, in the progressive multifocal lens concerning a means besides the above This main gaze line is right-and-left mirror symmetry bordering on Point P in the part which is not horizontally biased on the basis of the frequency measuring point F for **. The direction of change from Point P to [the part which this main gaze line is biasing to the nose side on the basis of the frequency measuring point F for **] a nose side is the progressive multifocal lens characterized by being more intense than change which results in a lug side.
[0014]
[Function] According to the above-mentioned means, it became possible to obtain the progressive multifocal lens which has the outstanding visual field region. Moreover, the design which thought the Nakama ** and near viewing as important is also employable as coincidence. Hereafter, an operation of the above-mentioned means is explained in detail.
[0015] In the progressive multifocal lens concerning the 1st above-mentioned means, the cure about the trouble produced when whenever [subscription] (Di) becomes large was taken into consideration in view of the progressive lens of whenever [bigger subscription / than aging] (Di) being needed.
[0016] That is, since the wearing person with whenever [subscription / comparatively small] (Di) is

comparatively young, ****** is active, the stability of the visual field (dynamic visual field) when moving a head and a look greatly is required, and since the wearing person with whenever [subscription / comparatively large] (Di) is advanced age comparatively, it is quiet ******, and the stability of the visual field (static visual field) when moving neither a head nor a look not much greatly is required conversely. Therefore, it is desirable the design, i.e., the astigmatism and its shaft orientations on a progressive multifocal lens, itself, average frequency (1/2 of number of spherical degrees + astigmatism frequency), and to change it further, with the value of whenever [subscription] (Di), in order to double distribution of the horizontal component of the prism power of a lens or a vertical component with the above-mentioned demand.

[0017] Moreover, it became clear that most correlation of the amount of marginal astigmatism of the clear vision zone in near viewing and whenever [subscription] (Di) is accepted, and clear vision of it could be carried out if it is ****, about 0.75, or the astigmatism of less than 1.00diopter as a result of the wearing test performed uniquely. Therefore, if it changes into the design which makes large more width of face W of the astigmatism of less than about 1.00diopter as a clear vision zone for Kon, so that whenever [subscription] (Di) becomes large, although the inclination for the clear vision zone for Kon to become narrow when it was [as opposed to / like before / the value of whenever / subscription / what kind of / (Di)] the same design and (Di) becomes large whenever [subscription] is not escaped, the above-mentioned inclination can be eased.

[0018] When the above point is summarized, whenever [subscription] (Di), for example From 0.25diopter to 5.00diopter When the value of the astigmatism in alignment with the horizontal cross-section curve which is equipped with the range of at least 0.75 to 3.00diopter, and passes along the frequency measuring point N for Kon sets width of face of the field below X diopter to W(Di, X) mm, whenever [this subscription] -- (Di) respectively -- Da Diopter and Db the relation of two kinds of lenses shown by diopter, A and B, -- setting -- whenever [this subscription] -- (Di) Da >Db it is -- the time -- W(Da, X) >W (Db, X-Db / Da)

(However, it considers as X= 1.00 diopter.) Then, when whenever [subscription] (Di) becomes large, the inclination for the clear vision zone for Kon to become narrow can be eased.

[0019] However, since the astigmatism of the side for Kon will increase if the astigmatism in the field for Kon is reduced when whenever [subscription] (Di) becomes large, although a static visual field is stabilized more, it becomes unstable [a dynamic visual field]. That is, the design which stabilizes a dynamic visual field in the progressive multifocal lens which has whenever [comparatively small subscription] is performed, if the above-mentioned approach is applied to the progressive multifocal lens which has whenever [comparatively large subscription], the static visual field of a progressive multifocal lens of having whenever [comparatively large subscription] will be stabilized, and the above-mentioned demand will also be made satisfied with coincidence.

[0020] Moreover, in order to make the progressive multifocal lens concerning the 1st means further easy to use in the 2nd means One curve which passes along three points, said frequency measuring point F for ** and eye point location E, and the number measuring point N of the Kon supplies, is assumed. The main gaze line is named in the semantics that the passage frequency of the look when gazing is the highest. The amount H of bias by the side of the horizontal nose on the basis of the location of the frequency measuring point F for ** of the point P of the arbitration on this main gaze line is Di about whenever [Dp and subscription] in the constant of the arbitration which is 1.0<=K<=4.0 about K, and the addition surface refractive power in Point P. When it carries out, The location on the lens of the main gaze line was defined noting that it was expressed with H=K-Dp/Di.

[0021] Along with the main gaze line, addition surface refractive power is increased for seeing the target of a nearer distance, and since it is that the look of a right-and-left eye approaches mutually further at a nose side (a congestion operation of an eye increases), seeing the target of a nearer distance needs to increase the amount of bias by the side of the nose of the main gaze line, in order to make it correspond to it. Therefore, the amount H of bias of the point P of the arbitration on the main gaze line is the addition surface refractive power Dp in Point P. Di It is proportional to the broken value. Moreover, it is because having given width of face to the value of the constant K of arbitration is refracted for the prism

operation by the horizontal component of the transparency refractive power of the lens in the location of the amount H of bias in case a look passes a lens, K becomes small when said transparency refractive power is negative, and K becomes large in a forward case. When transparency refractive power is 0, about K= 2.5 value is desirable.

[0022] In order that the 3rd means might make the progressive multifocal lens concerning the 1st or 2nd means further easy to use, it was presupposed to the point P of the arbitration on said main gaze line that it has the part from which two principal curvature differs except for the frequency measuring point F for **, and the number measuring point N of the Kon supplies.

[0023] as the item of the optical situation used so far -- the astigmatism and its shaft orientations on a progressive multifocal lens, and average frequency (1/2 of number of spherical degrees + astigmatism frequency) -- there is distribution of the horizontal component of the prism power of a lens or a vertical component etc. further. These have been treated mainly as a condition of a progressive multifocal-lens front face, in order to give explanation easy. That is, astigmatism was surface astigmatism on the front face of progressive, average frequency was surface average frequency on the front face of progressive, and prism power was a value computed comparatively simply from the difference of the direction of a normal of a progressive front face and a rear face etc. further.

[0024] However, since an actual lens is ******(ed) by the glasses frame and it is worn on the location of about 12mm of views in the state of anteversion of 5 degrees thru/or about 10 degrees Since it is obvious, that all (strictly optical path length of the look within a lens) of the include angle at which a look crosses a lens in fact, the thickness in the location, etc. are related With transparency astigmatism and average frequency, further, even if it regards as transparency average frequency and a value which should be computed from the deflection angle of a look with prism power, it is contained [astigmatism / above-mentioned] in the technical range of this invention (only the expression of whenever [subscription]). it is because having especially considered as "addition surface refractive power" is the definition whose it is whenever [subscription]. . Therefore, it is because having not considered as "the line (= navel-like meridian) without surface astigmatism" used well conventionally as explanation of said main gaze line has not considered as the indispensable requirements for this invention since it is not necessarily in the best condition in an actual operating condition that there is no surface astigmatism.

[0025] According to this invention person's etc. research, the "distance point" is the largest although the allocation of the size of a field in which the "distance point" in a common progressive multifocal lens, "pars intermedia", and a "reading point" can carry out clear vision has the difference in some according to the class of each progressive multifocal lens. This is because it is made to respond to the frequency of far viewing being very high in everyday life. Moreover, the inclination which becomes blunt is accepted as the sensibility of human being's eye to astigmatism also has the most sensitive far viewing and it moves from the Nakama ** to near viewing.

[0026] Even if it sees the result of the wearing test performed uniquely, it needs that the clear vision zone in far viewing is the astigmatism of less than about 0.50diopter, but in near viewing, if it is about 0.75 thru/or the astigmatism of less than 1.00diopter, it will have become clear that clear vision can be carried out. Therefore, it is judged that it is not rational to carry out the simple comparison of the size of each clear vision zone with the value of a certain fixed astigmatism. Furthermore, it becomes a big burden mentally that a distant visual field is narrowed for human being. This means that it only becomes the factor which the mental pressure "the constriction of a visual field" acts [factor] as a wearing person, and makes the glasses evade instead of the problem "whether they are convenience or inconvenience", and there is.

[0027] In view of this situation, with the progressive multifocal lens concerning other above-mentioned means, after the abbreviation sector which results in the direction of 150 degree from 30 degree on the basis of the location of said F is large and opening the clear vision zone for ** up, it was defined as the field of breadth, and the astigmatism in this clear vision zone for ** was made into 0.50 or less diopter irrespective of the value of whenever [subscription] (Di). Threshold value was defined regardless of the value of whenever [subscription] (Di) as a result of the wearing test performed uniquely because correlation of whenever [subscription] (Di) was hardly accepted in the amount of marginal astigmatism

of the clear vision zone in far viewing.
[0028] Moreover, it was determined for not making "the constriction of a visual field" hold in a wearing person the configuration of the clear vision zone for ** "was the field of breadth, after an abbreviation sector is large and opening up" as mentioned above. Furthermore, when the wearing person of the progressive multifocal lens concerning other means does front view, in order to change into the condition of having been suitable for seeing middle distance the eye point location E through which a look passes, addition surface refractive power in the eye point location E was made into whenever [subscription / 50% or less of] (Di) 30% or more. This is because it became clear that the clear vision zone for ** was not fully securable if change of the surface refractive power from the frequency measuring point E for ** to the number measuring point N of the Kon supplies could become intense at less than 30%, and the astigmatism of the middle visual field side could not fully be decreased and 50% was exceeded by many wearing tests.
[0029] Moreover, since the side will be widely used for eye backlash have fully decreased astigmatism rather than the usual progressive multifocal lens in the progressive multifocal lens concerning other means, it is necessary to make the binocular vision especially in the side good. Therefore, the symmetry axis which carries out all lens front faces for 2 minutes exists, and at the time of ******, since 5 degrees thru/or the so-called "bilateral symmetry die design" rotated 10 degrees are not taking the binocular vision in the side into consideration at all, the so-called "die design according to right and left" with the front face on which the lens for right eyes and the lens for left eyes are different from each other is preferably positioned as it is the optimal.
[0030] furthermore, about horizontal arrangement, said frequency measuring point F for **, the eye point location E, and the frequency measuring point N for Kon, of three points The location of the eye point location E is biased to the nose side rather than the location of the frequency measuring point F for ** in order to make the object for right eyes for left eyes correspond to a congestion operation of the eye at the time of near seeing, and the location of the frequency measuring point N for Kon needs to bias to the nose side further rather than the location of the eye point location E.
[0031] The location of the frequency measuring point F for ** by many wearing tests as arrangement of the lengthwise direction of these three points more preferably than the location of the eye point location E Moreover, 10mm thru/or 17mm, it biases to 12mm thru/or 15mm upper part more preferably -- making -- the location of the frequency measuring point N for Kon -- the eye point location E -- desirable -- 14mm -- or more preferably 21mm While 16mm thru/or making it bias caudad 19mm fully take the distance of the frequency measuring point F for **, and the number measuring point N of the Kon supplies and it could decrease refractive-power change, it became clear that it was the optimal coexistence range for carrying out impossible look migration to the field of two distances which is not.
[0032] Moreover, in order to make the progressive multifocal lens concerning a means besides the above further easy to use, it is further improvable by considering as the technique which shows below the contents of the "die design according to right and left" mentioned above. That is, in order to obtain a good binocular vision, it is further needed the astigmatism and its shaft orientations on the lens which a look passes, average frequency (1/2 of number of spherical degrees + astigmatism frequency), and to make the horizontal component and vertical component of prism power of a lens in agreement by the right-and-left eye. In here, when the target which it is going to see is in a lens wearing person's transverse plane, it is only sufficient to take into consideration arrangement of the above-mentioned main gaze line and allocation of surface refractive power.
[0033] However, since the look of the one eye moves to a lug side and the look of a fellow eye moves to a nose side when the target which it is going to see moves to a lens wearing person's side, the optical situation on the lens which both looks pass does not necessarily become the same. temporarily, since it become the same, for distribution of the optical situation on a lens, the include angle with which the look of a right and left eye will touch when move from front view to lateral view if the target which it be going to see be a lens wearing person method of infinite distance be right and left mirror symmetry (symmetry arrangement which placed and copied the mirror in the location of the main gaze line be mean, and it be the semantics of mere "bilateral symmetry".) horizontally bordering on the above-

mentioned main gaze line.
[0034] This is because that which is directive like the shaft orientations of astigmatism is also included in the above-mentioned "optical situation". Having become is desirable. On the other hand, if the target which it is going to see is a lens wearing person's finite distance, the look of a right-and-left eye has come together mutually according to a congestion operation of an eye at the nose side. If the distance to a target is eternal when moving from front view to lateral view in this condition, the include angle with which the look of a right-and-left eye touches will become the same. However, as for the distance to a target, keeping away is common, when moving from front view to lateral view so that it may understand immediately if it thinks taking the case of the method of Kon very much. If it becomes so, a congestion operation of an eye will become weaker and the look of both eyes will become near in parallel.
[0035] Therefore, if the target which it is going to see is in a lens wearing person's finite distance, the look which the include angles with which the look of a right-and-left eye touches differ when moving from front view to lateral view, and moves to a lug side is larger than the look which moves to a nose side. On the spectacle lens which rotates with a head [for rotation (a head rotates the abbreviation one half of the include angle which usually moves from front view to lateral view, and an eyeball rotates the remainder.) of the head in lateral view], this inclination is condensed further and becomes remarkable. For this reason, in order to see finite distance, it is desirable for the main gaze line to serve as right-and-left asymmetry horizontally in the part currently biased to the nose side on the basis of the location of said F.
[0036] it is more desirable than change to which the direction of change from the main gaze line to a nose side results in a lug side at a progressive multifocal lens in order to make the same the optical situation on the lens which a look on either side passes, since changing usually comes out and distribution of the optical situation on the lens from the main gaze line to a horizontal direction has it that it is intense.
[0037] Change of the astigmatism which meets the horizontal cross-section curve which intersects the point P of the arbitration on said main gaze line if the above point is summarized, Change of the shaft orientations of astigmatism, change of average refractive power, change of the horizontal component of prism power, At least one of the optical situations, such as change of the vertical component of prism power, considers as right-and-left mirror symmetry bordering on Point P in the part which is not horizontally biased on the basis of the location of the frequency measuring point F for **. In the part currently biased to the nose side on the basis of the location of the frequency measuring point F for **, it will be said that it is desirable for the direction of change from Point P to a nose side to be more intense than change which results in a lug side.
[0038]
[Embodiment of the Invention] (Example 1) Drawing 1 is drawing explaining the layout of the optical information of the progressive multifocal lens for right eyes of this example 1. In drawing 1 in the location of 14mm of upper parts of the geometric core O of a lens The frequency measuring point F for ** When the wearing person of a lens carries out front view to the location of 17.5mm of lower parts of the geometric core O of a lens, and 2.5mm of methods of the inside of a nose side in the location of 1.0mm the horizontal nose side of the frequency measuring point N for Kon, and the geometric core of a lens, the location E through which a look passes exists (drawing is drawn a little exaggerative on explanation).
[0039] It sets to this example and is the frequency for **. Whenever [S-1.00 diopter and subscription] It is Di =+2.00 diopter. The addition surface refractive power in the frequency measuring point E for ** is +0.76 diopter, and this is equivalent to whenever [subscription / about 38% of] (Di). When level right-hand side is made into a 0-degree reference direction for the location of the frequency measuring point F for ** on a lens as a core, the field Df of the abbreviation sector which results in the direction of 150 degree from 30 degree is a clear vision zone for **, and the astigmatism in this field is 0.50 or less diopter.
[0040] Although one thick curve of the lens of drawing 1 which is in a central lengthwise direction mostly is the main gaze line and the lens is divided into "a part for "a part for a nose flank", and a lug

flank" through three points, the frequency measuring point F for **, the eye point location E, and the number measuring point N of the Kon supplies, the amount of these two surface parts are horizontally unsymmetrical.
[0041] Drawing showing the amount H of bias in the point P of the arbitration on this main gaze line is drawing 2 , and drawing showing the addition surface refractive power D in the point P of the arbitration on this main gaze line is drawing 3 . As for the abscissa in drawing 2 and drawing 3 , the upper part and a negative-number value express [the positive-number value] the downward location from the geometric central point of a lens. At a glance, the configuration of the graph in drawing 2 and drawing 3 is alike, and only ordinates differ so that it may understand. H=K-D/Di, it is because there is unrelated relation of direct proportion, and this is the constant [K] 2.5 here at H and D.
[0042] (Example 2) Drawing 4 is drawing explaining the layout of the optical information of the progressive multifocal lens for right eyes of this example 2. In drawing 4 , when the wearing person of a lens carries out front view to the location of 1.0mm in the location of 17.5mm of lower parts of the frequency measuring point F for **, and the geometric core of a lens, and 1.5mm of methods of the inside of a nose side at the frequency measuring point N for Kon, and the location of the geometric core of a lens 14mm horizontal lug side of upper parts of the geometric core of a lens, the location E through which a look passes exists.
[0043] This example serves as arrangement which made both three points, the frequency measuring point F for ** in the example 1 shown in drawing 1 , the eye point location E, and the number measuring point N of the Kon supplies, bias only 1.0mm to a horizontal lug side. Others are the same as that of the progressive multifocal lens of an example 1.
[0044] The advantage over the lens of the example 1 of the lens of this example 2 is to be able to perform easily making the eye point location E in agreement with the central point on rear-face processing, and making it into the point of measurement of prism power.
[0045] (Example 3) Drawing 5 and drawing 6 are drawings showing astigmatism distribution of the progressive multifocal lens of an example 3. Here, drawing 5 supports to subscription frequency Da =+1.00 diopter, drawing 6 supports the example of two progressive multifocal lenses of subscription frequency Db =+2.00 diopter, respectively, the curve (continuous line) drawn on each is an astigmatic contour line for every 0.25diopter, and the numeric value described by the side of each curve expresses the amount of astigmatism (unit: diopter).
[0046] The frequency measuring point F for ** described at each of drawing 5 and drawing 6 , the eye point location E, and the frequency measuring point N for Kon are the same arrangement as an example 1, and one curve (dotted line) of a lens which is in a central lengthwise direction mostly is the main gaze line, and they pass along three points, the frequency measuring point F for **, the eye point location E, and the number measuring point N of the Kon supplies. The main gaze line is right-and-left mirror symmetry among astigmatic spacing of a contour line drawn on each in the part (above the frequency measuring point F for **) which is not horizontally biased on the basis of the location of the frequency measuring point F for **. The main gaze line in the part (below the frequency measuring point F for **) currently biased to the nose side on the basis of the location of the frequency measuring point F for ** "The amount of [the amount of" (right-hand side)] nose flank is "dense", "the amount of [the amount of" (left-hand side)] lug flank is a "non-dense", and the direction of change from the main gaze line to a nose side is more intense than change which results in a lug side. This description is the same also in the horizontal component and vertical component of the shaft orientations of not only astigmatism but astigmatism, average refractive power, and prism power.
[0047] Moreover, when the value of the astigmatism in alignment with the horizontal cross-section curve which passes along the frequency measuring point N for Kon sets width of face of the field below X diopter to W(Di, X) mm, whenever [subscription] -- (Di) -- respectively -- Da Diopter and Db the relation of two kinds of lenses shown by diopter, A and B, -- setting -- whenever [subscription] -- (Di) Da >Db it is -- the time -- W(Da, X) >W (Db, X-Db / Da)
The relation of (however, considering as X=1.00 diopter) is filled.
[0048] Therefore, the reading point W2 of W1=W (1. 00 0.50) and drawing 6 is expressed for the

reading point W1 of drawing 5 as W2=W (2. 00 1.00). So, since the lens of drawing 5 is whenever [twice as many subscription / as the lens of drawing 6], if it is the design with same lens of drawing 5 and lens of drawing 6 , the lens of drawing 6 should become equal to what piled up two lenses of drawing 5 . That is, the width of face (W2) of amount of astigmatism 1.00 diopter in Db =+2.00 diopter should become [whenever / subscription] equal to the width of face (W1) of amount of astigmatism 0.50 diopter in Da =+1.00 diopter whenever [subscription].

[0049] However, in the lens of drawing 5 , and the lens of drawing 6 , when the width of face of two horizontal arrow heads which pass along N was compared, it has become W2>W1 (1. 00 0.50), i.e., W (2. 00 1.00) >W, and whenever [subscription] becomes large, it turns out that the design which eases the inclination for the clear vision zone for Kon to become narrow is carried out.

[0050] (Example 4) Drawing 7 is drawing showing astigmatism distribution of the progressive multifocal lens for right eyes of an example 4. In this example, the frequency for ** is S+1.50diopter, subscription frequency is Di =+2.00 diopter, a curve (continuous line) is an astigmatic contour line for every 0.25diopter, and the numeric value described by the side of each curve expresses the amount of astigmatism (unit: diopter).

[0051] When the wearing person of a lens carries out front view to the location of 15mm of upper parts of the geometric core O of a lens in the location of 19mm of lower parts of the frequency measuring point F for **, and the geometric core O of a lens, and 2.5mm of methods of the inside of a nose side at the location of 1.0mm the frequency measuring-point N for Kon, and horizontal nose side of the geometric core O of a lens, the location E through which a look passes exists. One curve (dotted line) of a lens which is in a central lengthwise direction mostly is the main gaze line, and passes along three points, the frequency measuring point F for **, the eye point location E, and the number measuring point N of the Kon supplies. There is a part which intersects the astigmatic contour line in the lower part of this main gaze line, and it turns out that the part from which two principal curvature in each point which meets this main gaze line differs exists in the lens lower part.

[0052] If a lens is ******(ed) by the glasses frame and it is worn on the location of about 12mm of views in the state of 7-degree anteversion in this example receives in the direction of all looks under an assumption. The lens front face was set up so that a look may be in distribution of transparency astigmatism, distribution of transparency average frequency, and the condition that distribution of the deflection angle of a look etc. is still more desirable, in consideration of the include angle which crosses a lens, the optical path length of the look within the lens in the location, etc. Consequently, the part from which two principal curvature in each point which meets the main gaze line differs arose. However, only said location of F and N set up two principal curvature equally on account of the inspection process.

[0053]

[Effect of the Invention] As explained in full detail above, the progressive multifocal lens concerning this invention has the outstanding visual field function, and there are few shakes of the image of the side, and it is equipped with the progressive multifocal lens which has the object for **, an object for Kon, and the visual field region that maintained middle balance.

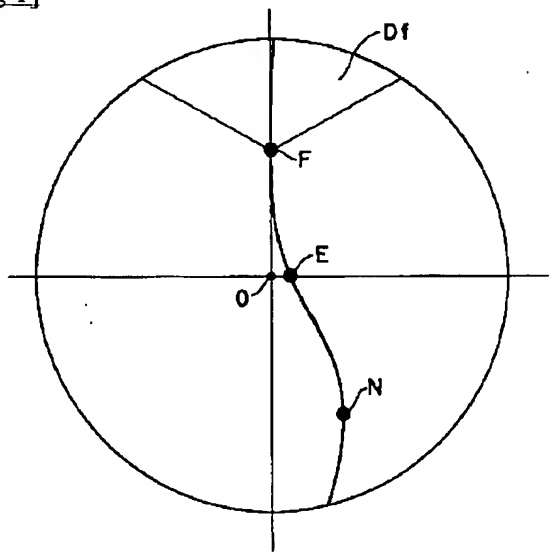
[Translation done.]

* NOTICES *

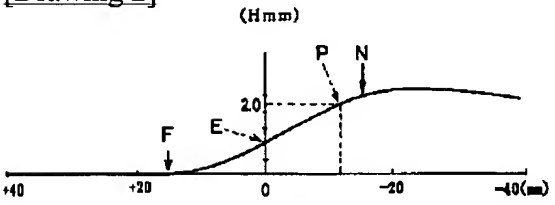
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

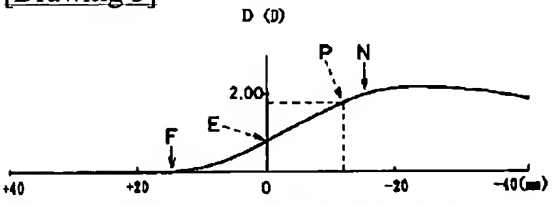


[Drawing 2]



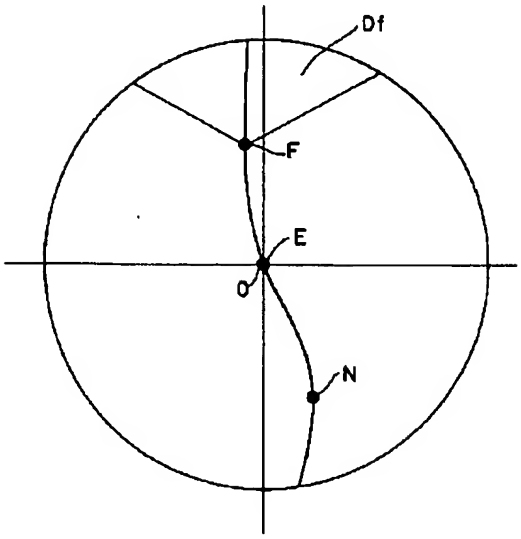
主注視線上の任意の点Pにおける偏位量Hを示す図(ADD=2.00, E=2.5)

[Drawing 3]

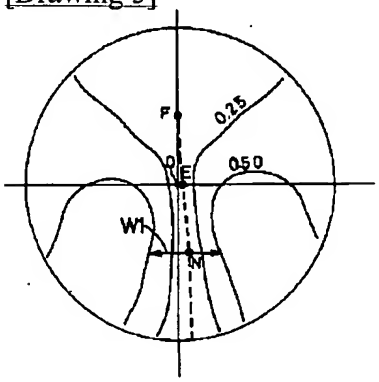


主注視線上の任意の点Pにおける付加表面屈折力Dを示す図(ADD=2.00)

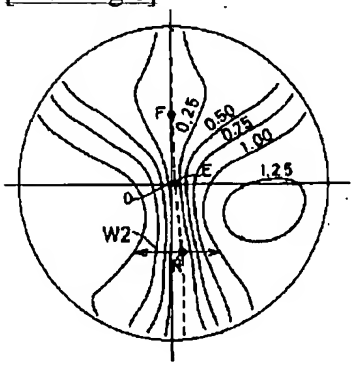
[Drawing 4]



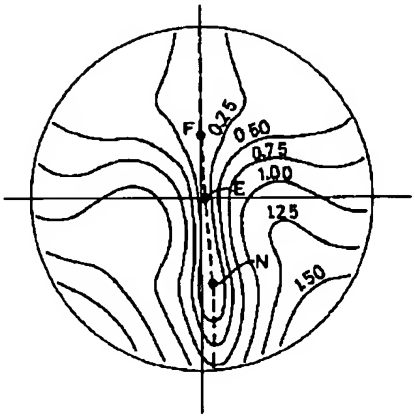
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]